

Appendix BExperimental Data

Table B.1 Summary of experimental solids concentrations for chromium kinetic and equilibrium studies.

SOIL	SOLIDS CONCENTRATION					
	50K <sup>†</sup> mg·L <sup>-1</sup>		5K <sup>†</sup> mg·L <sup>-1</sup>		1K <sup>†</sup> mg·L <sup>-1</sup>	
7DS00101KD	51000	± 1284	4868	± 514	954	± 81
7DS00301KD	49882	± 1161	4830	± 70	928	± 114
7DS00501KD	52784	± 8065	4598	± 906	752	± 238
7DS00701KD	49306	± 7464	5106	± 1329	858	± 176
7DS00901KD	45156	± 4716	4650	± 865	1062	± 638
7DS01701KD	53324	± 4136	5238	± 284	854	± 59
7DS02301KD	52758	± 1171	5086	± 128	968	± 75
I2S-INEEL-105	52762	± 1656	5334	± 187	1028	± 63
I1S-INEEL-109	40212	± 1564	4046	± 325	738	± 151
I4D-INEEL-224	44766	± 234	4764	± 902	632	± 77
I3D-INEEL-229	50644	± 10164	5072	± 969	772	± 114
I4D-INNEL-231	51100	± 2912	4888	± 442	941	± 122
I1D-INNEL-234	44992	± 11449	4084	± 1421	580	± 174
I4D-INNEL-234	36008	± 4534	3918	± 700	564	± 127

<sup>†</sup>Results are reported at ± 95% confidence interval.

Table B.2 Summary of experimental solids concentrations for uranium kinetic and equilibrium studies.

SOIL	SOLIDS CONCENTRATION		
	GWS <sup>†</sup>	GWS (-CO <sub>3</sub> <sup>2-</sup> ) <sup>†</sup>	GWS (-CO <sub>3</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , F <sup>-</sup> ) <sup>†</sup>
	mg·L <sup>-1</sup>	mg·L <sup>-1</sup>	mg·L <sup>-1</sup>
7DS00101KD	96176 ± 1467	N/A	N/A
7DS00301KD	91492 ± 809	N/A	N/A
7DS00501KD	59872 ± 8050	N/A	N/A
7DS00701KD	44104 ± 7685	N/A	N/A
7DS00901KD	82284 ± 9031	N/A	N/A
7DS01701KD	92900 ± 2915	N/A	N/A
7DS02301KD	94088 ± 4321	N/A	N/A
I2S-INEEL-105	95444 ± 1683	49834 ± 807	49803 ± 478
I1S-INEEL-109	73300 ± 2252	N/A	N/A
I4D-INEEL-224	70804 ± 2219	N/A	N/A
I3D-INEEL-229	77380 ± 13262	N/A	N/A
I4D-INNEL-231	88500 ± 2522	N/A	N/A
I1D-INNEL-234	59188 ± 6315	N/A	N/A
I4D-INNEL-234	59636 ± 4896	49164 ± 987	49354 ± 490

<sup>†</sup>Results are reported at ± 95% confidence interval.

Table B.3 Summary of experimental solids concentrations for neptunium kinetic and equilibrium studies.

SOIL	SOLIDS CONCENTRATION		
	GWS <sup>†</sup>	GWS (-CO <sub>3</sub> <sup>2-</sup> ) <sup>†</sup>	GWS (-CO <sub>3</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , F <sup>-</sup> ) <sup>†</sup>
	mg·L <sup>-1</sup>	mg·L <sup>-1</sup>	mg·L <sup>-1</sup>
7DS00101KD	96414 ± 1997	N/A	N/A
7DS00301KD	92718 ± 2417	N/A	N/A
7DS00501KD	70880 ± 14914	N/A	N/A
7DS00701KD	52524 ± 15582	N/A	N/A
7DS00901KD	89626 ± 8006	N/A	N/A
7DS01701KD	94790 ± 2151	N/A	N/A
7DS02301KD	95190 ± 1598	N/A	N/A
I2S-INEEL-105	93054 ± 1183	49990 ± 506	50116 ± 489
I1S-INEEL-109	71682 ± 1935	N/A	N/A
I4D-INEEL-224	86734 ± 1502	N/A	N/A
I3D-INEEL-229	89494 ± 6575	N/A	N/A
I4D-INNEL-231	91908 ± 6534	N/A	N/A
I1D-INNEL-234	73414 ± 12025	N/A	N/A
I4D-INNEL-234	65184 ± 5124	49570 ± 125	49544 ± 8696

<sup>†</sup>Results are reported at ± 95% confidence interval.

Table B.4 Summary of experimental initial aqueous phase concentrations for radionuclide kinetic and equilibrium studies.

RADIONUCLIDE	INITIAL AQUEOUS PHASE CONCENTRATION <sup>†</sup>		
	GWS <sup>†</sup>		GWS (-CO <sub>3</sub> <sup>2-</sup> ) <sup>†</sup> Bq-mL <sup>-1</sup>
	Bq-mL <sup>-1</sup>	GWS (-CO <sub>3</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , F) <sup>†</sup> Bq-mL <sup>-1</sup>	
CHROMIUM-51	32 ± 0.98	N/A	N/A
URANIUM-233	8.8 ± 0.59	4.0 ± 0.00	7.0 ± 0.39
	22 ± 2.00	20 ± 0.20	10 ± 0.39
	38 ± 0.59	40 ± 0.59	14 ± 0.78
	76 ± 0.98	N/A	N/A
	176 ± 3.30	N/A	N/A
NEPTUNIUM-237	4.9 ± 0.20	3.7 ± 0.00	3.7 ± 0.00
	12 ± 0.20	19 ± 0.20	19 ± 0.20
	24 ± 0.20	38 ± 0.00	38 ± 0.00
	49 ± 0.59	N/A	N/A
	95 ± 1.20	N/A	N/A

<sup>†</sup> Results are reported at ± 95% confidence interval.

Table B.5 Summary of initial uranium-233 aqueous activity and mass concentrations and equivalent natural uranium activity and mass concentrations.

SIMULANT	INITIAL AQUEOUS CONCENTRATION							
	U-233 <sup>†</sup>				Natural U <sup>†</sup> (99.3% $^{238}\text{U}$ ; 0.07% $^{235}\text{U}$ )			
	Bq-mL <sup>-1</sup>	mg-L <sup>-1</sup>	Bq-mL <sup>-1</sup>	mg-L <sup>-1</sup>				
GWS	8.8 $\pm$ 0.59	0.025 $\pm$ 0.002	0.0019 $\pm$ 0.0001	0.025 $\pm$ 0.002				
	22 $\pm$ 2.00	0.062 $\pm$ 0.006	0.0048 $\pm$ 0.0004	0.063 $\pm$ 0.006				
	38 $\pm$ 0.59	0.11 $\pm$ 0.002	0.0083 $\pm$ 0.0001	0.11 $\pm$ 0.002				
	76 $\pm$ 0.98	0.21 $\pm$ 0.003	0.017 $\pm$ 0.0002	0.22 $\pm$ 0.003				
	176 $\pm$ 3.30	0.49 $\pm$ 0.009	0.038 $\pm$ 0.0007	0.50 $\pm$ 0.009				
GWS(-CO <sub>3</sub> <sup>2-</sup> )	4.0 $\pm$ 0.00	0.011 $\pm$ 0.000	0.0009 $\pm$ 0.0000	0.012 $\pm$ 0.000				
	20 $\pm$ 0.20	0.056 $\pm$ 0.001	0.0044 $\pm$ 0.0001	0.057 $\pm$ 0.001				
	40 $\pm$ 0.59	0.11 $\pm$ 0.002	0.0087 $\pm$ 0.0001	0.12 $\pm$ 0.002				
GWS(-CO <sub>3</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , F <sup>-</sup> )	7.0 $\pm$ 0.39	0.020 $\pm$ 0.001	0.0015 $\pm$ 0.0001	0.020 $\pm$ 0.001				
	10 $\pm$ 0.39	0.028 $\pm$ 0.001	0.0022 $\pm$ 0.0001	0.029 $\pm$ 0.001				
	14 $\pm$ 0.78	0.039 $\pm$ 0.002	0.0031 $\pm$ 0.0002	0.040 $\pm$ 0.002				

<sup>†</sup> Results are reported at  $\pm$  95% confidence interval.

Table B.6 Summary of equilibrium study data for uranium on fourteen soil samples and blanks in GWS.

SOIL	CONCENTRATIONS					
	Aqueous Phase <sup>†</sup>			Sorbed Phase <sup>†</sup>		
	Bq·mL <sup>-1</sup>	Bq·g <sup>-1</sup>	Bq·g <sup>-1</sup>	Bq·g <sup>-1</sup>	Bq·g <sup>-1</sup>	Bq·g <sup>-1</sup>
<b>pH: 7.9±0.1</b>						
7DS00101KD	1.1 ± 0.04			79 ± 0.4		
	3.3 ± 0.06			194 ± 0.6		
	5.8 ± 0.08			332 ± 0.8		
	14 ± 0.54			644 ± 5.6		
	40 ± 0.28			1409 ± 2.9		
7DS00301KD	1.8 ± 0.17			77 ± 1.8		
	4.7 ± 0.42			188 ± 4.6		
	8.7 ± 0.16			318 ± 1.7		
	20 ± 0.42			604 ± 4.6		
	62 ± 0.41			1243 ± 4.5		
7DS00501KD	3.2 ± 0.30			93 ± 5.1		
	8.8 ± 0.61			220 ± 10		
	16 ± 1.00			371 ± 17		
	40 ± 2.80			599 ± 48		
	90 ± 6.10			1428 ± 101		
7DS00701KD	4.5 ± 0.36			98 ± 8.2		
	12 ± 1.60			219 ± 36		
	21 ± 0.01			392 ± 0.3		
	48 ± 3.40			633 ± 77		
	121 ± 3.70			1236 ± 84		
7DS00901KD	2.2 ± 0.01			80 ± 0.2		
	6.3 ± 0.38			190 ± 4.6		
	11 ± 0.83			322 ± 10		
	29 ± 5.80			565 ± 70		
	78 ± 1.50			1185 ± 18		
7DS01701KD	2.3 ± 0.08			70 ± 0.8		
	6.4 ± 0.11			168 ± 1.2		
	11 ± 0.00			285 ± 0.0		
	27 ± 0.02			526 ± 0.2		
	78 ± 1.20			1050 ± 13		
7DS02301KD	2.5 ± 0.13			67 ± 1.4		
	6.5 ± 0.10			165 ± 1.1		
	12 ± 0.31			279 ± 3.3		
	27 ± 1.20			514 ± 13		
	74 ± 0.80			1080 ± 8.5		

<sup>†</sup> Results are reported at ± 95% confidence interval.

Table B.5 continued.

SOIL	CONCENTRATIONS		
	Aqueous Concentration <sup>†</sup>		Sorbed Concentration <sup>†</sup>
	Bq·mL <sup>-1</sup>	Bq·g <sup>-1</sup>	
<b>I2S-INEEL-105</b>	2.2 ± 0.01	69 ± 0.0	
	6.3 ± 0.18	164 ± 1.9	
	11 ± 0.00	284 ± 0.0	
	26 ± 1.20	524 ± 12	
	74 ± 0.34	1067 ± 3.6	
<b>I1S-INEEL-109</b>	3.1 ± 0.49	78 ± 6.7	
	8.4 ± 0.07	186 ± 0.9	
	15 ± 0.36	312 ± 5.0	
	34 ± 0.08	568 ± 1.1	
	94 ± 0.83	1114 ± 11	
<b>I4D-INEEL-224</b>	3.2 ± 0.21	78 ± 3.0	
	9.1 ± 0.86	181 ± 12	
	16 ± 0.31	312 ± 4.4	
	35 ± 0.25	572 ± 3.5	
	93 ± 1.90	1165 ± 27	
<b>I3D-INEEL-229</b>	3.6 ± 0.02	67 ± 0.3	
	9.4 ± 0.38	162 ± 5.0	
	17 ± 0.41	266 ± 5.3	
	38 ± 0.48	490 ± 6.2	
	105 ± 2.00	907 ± 26	
<b>I4D-INEEL-231</b>	2.9 ± 0.16	67 ± 1.8	
	7.9 ± 0.20	158 ± 2.3	
	15 ± 0.09	260 ± 1.1	
	32 ± 0.07	488 ± 0.8	
	94 ± 4.70	918 ± 53	
<b>I1D-INEEL-234</b>	3.0 ± 0.26	97 ± 4.3	
	7.8 ± 0.10	239 ± 1.8	
	14 ± 0.60	406 ± 10	
	30 ± 1.40	773 ± 24	
	79 ± 0.07	1633 ± 1.2	
<b>I4D-INEEL-234</b>	4.7 ± 0.08	68 ± 1.4	
	12 ± 0.27	163 ± 4.6	
	22 ± 0.23	264 ± 3.9	
	49 ± 0.90	450 ± 15	
	125 ± 0.65	844 ± 11	
<b>BLANKS</b>	8.8 ± 0.39	N/A	
	22 ± 0.35	N/A	
	38 ± 1.10	N/A	
	77 ± 0.76	N/A	
	174 ± 2.90	N/A	

<sup>†</sup> Results are reported at ± 95% confidence interval.

Table B.7 Summary of ligand study data for uranium on two soil samples and blanks in GWS(-CO<sub>3</sub><sup>2-</sup>) and GWS(-CO<sub>3</sub><sup>2-</sup>, SO<sub>4</sub><sup>2-</sup>, F<sup>-</sup>)

SOIL	GWS(-CO <sub>3</sub> <sup>2-</sup> )		GWS(-CO <sub>3</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , F <sup>-</sup> )	
	Aqueous Concentration <sup>†</sup> Bq-mL <sup>-1</sup>	Sorbed Concentration <sup>†</sup> Bq-g <sup>-1</sup>	Aqueous Concentration <sup>†</sup> Bq-mL <sup>-1</sup>	Sorbed Concentration <sup>†</sup> Bq-g <sup>-1</sup>
I2S-INEEL-105		pH: 7.22±0.04		pH: 7.35±0.10
	0.02 ± 0.01	76 ± 0.6	0.04 ± 0.01	140 ± 0.5
	0.19 ± 0.004	379 ± 0.5	0.18 ± 0.22	204 ± 3.9
	0.59 ± 0.08	751 ± 4.6	0.08 ± 0.03	278 ± 0.5
I4D-INEEL-234		pH: 7.91±0.08		pH: 7.80 ±0.03
	1.0 ± 0.01	62 ± 0.5	1.8 ± 0.30	105 ± 5.0
	9.3 ± 0.01	218 ± 1.4	2.9 ± 0.0004	151 ± 2.3
	23 ± 1.70	330 ± 32	4.2 ± 0.07	198 ± 1.0
BLANKS		pH: 7.17±0.04		pH: 7.25±0.03
	0.61 ± 0.05	N/A	2.5 ± 2.50	N/A
	9.3 ± 0.46	N/A	6.7 ± 2.40	N/A
	25 ± 0.35	N/A	2.4 ± 0.37	N/A

<sup>†</sup> Results are reported at ± 95% confidence interval.

Table B.8 Summary of equilibrium study data for neptunium on fourteen soil samples and blanks in GWS.

SOIL	AQUEOUS CONCENTRATION <sup>†</sup>		SORBED CONCENTRATION <sup>†</sup>	
	Bq·mL <sup>-1</sup>	Bq·g <sup>-1</sup>	Bq·mL <sup>-1</sup>	Bq·g <sup>-1</sup>
pH: 7.7±0.1				
<b>7DS00101KD</b>	0.071 ± 0.012		50.4 ± 0.1	
	0.34 ± 0.012		123 ± 0.1	
	0.87 ± 0.042		244 ± 0.4	
	2.8 ± 0.041		475 ± 0.4	
	9.6 ± 0.370		887 ± 3.8	
<b>7DS00301KD</b>	0.36 ± 0.053		49 ± 0.6	
	1.5 ± 0.062		116 ± 0.7	
	4.2 ± 0.430		219 ± 4.6	
	11 ± 0.720		401 ± 7.8	
	29 ± 0.800		717 ± 8.6	
<b>7DS00501KD</b>	0.25 ± 0.025		66 ± 0.4	
	0.95 ± 0.073		160 ± 1.0	
	2.9 ± 0.210		304 ± 2.9	
	9.8 ± 1.800		546 ± 26	
	28 ± 1.100		949 ± 16	
<b>7DS00701KD</b>	1.9 ± 0.160		57 ± 3.0	
	6.0 ± 0.930		120 ± 18	
	13 ± 0.220		210 ± 4.2	
	30 ± 1.900		360 ± 35	
	66 ± 2.500		553 ± 48	
<b>7DS00901KD</b>	0.40 ± 0.046		51 ± 0.5	
	1.5 ± 0.081		121 ± 0.9	
	4.1 ± 0.240		227 ± 2.6	
	13 ± 0.240		401 ± 2.7	
	33 ± 0.680		690 ± 7.6	
<b>7DS01701KD</b>	0.19 ± 0.038		50 ± 0.4	
	0.79 ± 0.120		121 ± 1.3	
	2.5 ± 0.120		232 ± 1.3	
	7.9 ± 0.076		428 ± 0.8	
	24 ± 0.750		748 ± 7.9	
<b>7DS02301KD</b>	0.24 ± 0.042		49 ± 0.4	
	1.2 ± 0.013		117 ± 0.1	
	3.5 ± 0.056		221 ± 0.6	
	10 ± 0.340		401 ± 3.5	
	28 ± 0.220		708 ± 2.3	

<sup>†</sup> Results are reported at ± 95% confidence interval.

Table B.7 continued.

SOIL	AQUEOUS CONCENTRATION <sup>†</sup>			SORBED CONCENTRATION <sup>†</sup>		
			Bq·mL <sup>-1</sup>			Bq·g <sup>-1</sup>
<b>I2S-INEEL-105</b>	0.82	±	0.04		44	± 0.4
	2.7	±	0.10		103	± 1.1
	6.9	±	0.07		189	± 0.7
	17	±	0.54		337	± 5.8
	42	±	0.95		574	± 10
<b>I1S-INEEL-109</b>	0.10	±	0.04		67	± 0.5
	0.38	±	0.04		166	± 0.5
	1.1	±	0.04		325	± 0.6
	3.8	±	0.24		623	± 3.4
	13	±	0.07		1148	± 1.0
<b>I4D-INEEL-224</b>	0.15	±	0.02		55	± 0.3
	0.69	±	0.03		134	± 0.4
	2.1	±	0.15		258	± 1.7
	7.1	±	0.67		477	± 7.7
	23	±	0.64		836	± 7.4
<b>I3D-INEEL-229</b>	0.08	±	0.03		54	± 0.3
	0.28	±	0.06		134	± 0.7
	0.88	±	0.05		264	± 0.6
	3.0	±	0.03		508	± 0.3
	12	±	1.10		929	± 12
<b>I4D-INEEL-231</b>	0.21	±	0.02		52	± 0.2
	0.93	±	0.08		124	± 0.8
	3.1	±	0.03		232	± 0.4
	9.9	±	0.33		420	± 3.6
	30	±	1.60		712	± 18
<b>I1D-INEEL-234</b>	0.47	±	0.12		61	± 1.6
	1.9	±	0.25		141	± 3.3
	5.4	±	0.13		260	± 1.8
	14	±	1.60		464	± 22
	35	±	1.60		820	± 22
<b>I4D-INEEL-234</b>	0.63	±	0.09		66	± 1.4
	2.6	±	0.33		149	± 5.1
	7.6	±	0.04		259	± 0.7
	21	±	0.87		424	± 13
	49	±	1.50		702	± 23
<b>BLANKS</b>	4.7	±	0.17		N/A	
	12	±	0.71		N/A	
	24	±	0.24		N/A	
	48	±	1.90		N/A	
	97	±	1.40		N/A	

<sup>†</sup> Results are reported at ± 95% confidence interval.

Table B.9 Summary of ligand study data for neptunium on two soil samples and blanks in GWS(-CO<sub>3</sub><sup>2-</sup>) and GWS(-CO<sub>3</sub><sup>2-</sup>, SO<sub>4</sub><sup>2-</sup>, F<sup>-</sup>)

SOIL	GWS(-CO <sub>3</sub> <sup>2-</sup> )		GWS(-CO <sub>3</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , F <sup>-</sup> )	
	Aqueous Concentration <sup>†</sup> Bq-mL <sup>-1</sup>	Sorbed Concentration <sup>†</sup> Bq-g <sup>-1</sup>	Aqueous Concentration <sup>†</sup> Bq-mL <sup>-1</sup>	Sorbed Concentration <sup>†</sup> Bq-g <sup>-1</sup>
I2S-INEEL-105		pH: 7.28±0.07		pH: 7.27±0.10
	1.1 ± 0.09	52 ± 1.2	1.0 ± 0.15	54 ± 3.2
	9.0 ± 0.06	205 ± 3.3	7.9 ± N/A	225 ± N/A
	20 ± 0.71	378 ± 16	19 ± 1.40	388 ± 23
I4D-INEEL-234		pH: 7.80±0.05		pH: 7.80 ±0.01
	0.91 ± 0.02	56 ± 0.6	0.76 ± 0.08	57 ± 6.5
	8.4 ± 0.32	219 ± 5.9	7.2 ± 0.95	261 ± 5.4
	20 ± 2.5	361 ± 50	19 ± 0.26	393 ± 106
BLANKS		pH: 7.05±0.08		pH: 7.04±0.03
	3.6 ± 0.55	N/A	3.8 ± 0.08	N/A
	19 ± 0.15	N/A	19 ± 0.22	N/A
	36 ± 2.2	N/A	38 ± 0.08	N/A

<sup>†</sup>Results are reported at ± 95% confidence interval.

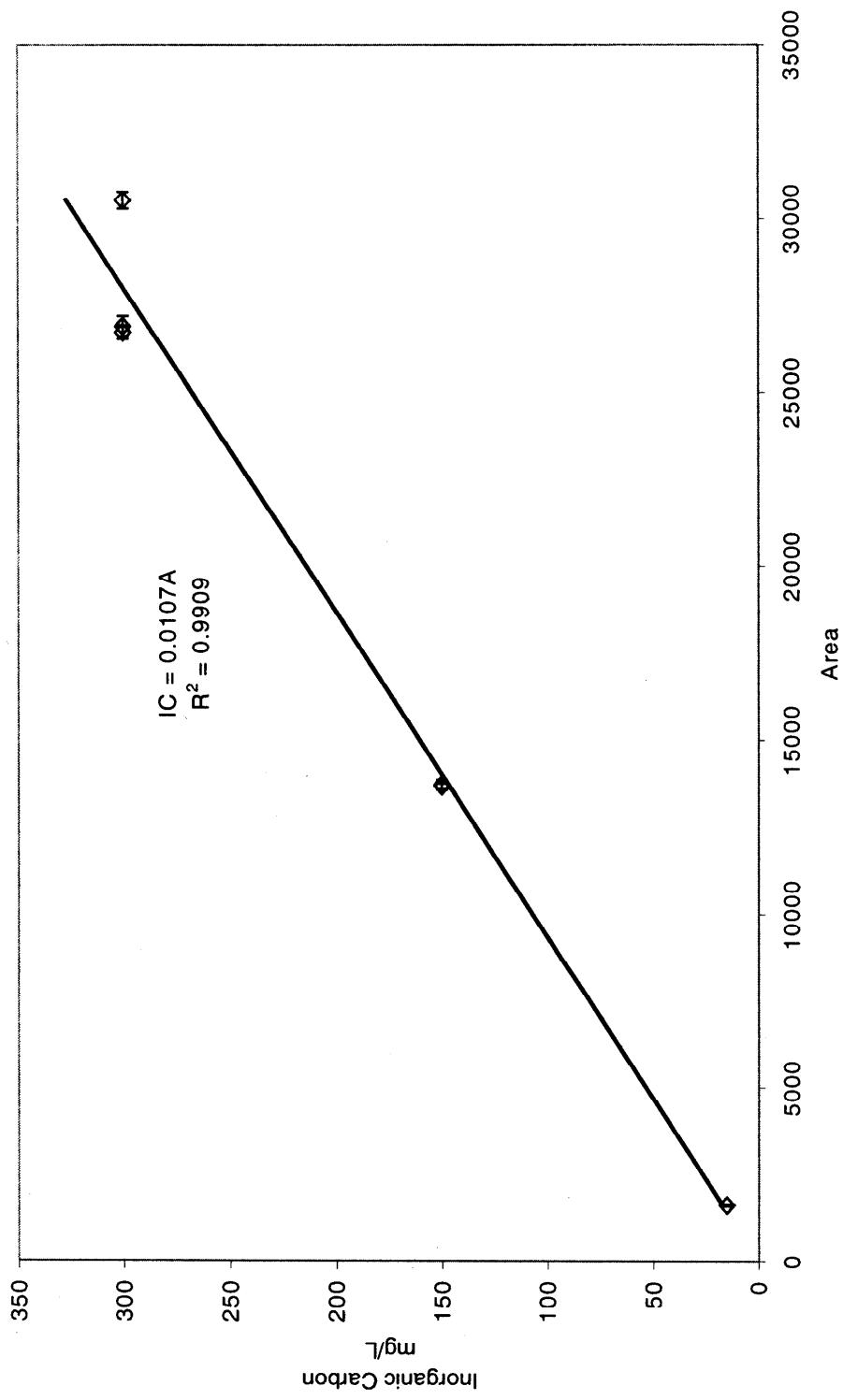


Figure B.1 Calibration curve for inorganic carbon determinations.